The RPRCC Initiative: Attracting Young Women to Computing Majors an ACM-W Project

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Our Agenda

- Recruiting more young women into software development (SD)-related undergraduate majors...and then retaining them in those majors...starting in middle and high schools

- Doing so in the context of a course taken for credit towards graduation

- Doing so in a way that also enables students to perform useful work for local socially relevant agencies (service learning)

Why

- female point of view is necessary in the design and development of everything from consumer products to defense-related systems
- US Bureau of Labor Statistics (BLS) predicts large increase in SD-related jobs in the next decade *in spite of offshore outsourcing and in spite of the recession*
- CS/IT/IS/SwE BS grads start at $60,000 in the US
- A world/classroom with only male faces feels very unnatural

Why a New Approach is Needed

- Recruitment
  - 1950-1980: percentage of CS majors who were female was approximately 35%
  - Currently: percentage of entering female CS majors is about 10%-11%
- Retention
  - overall 4-year dropout rate as high as 40%-60%
  - female dropout rate is higher than male dropout rate

Results of Recruitment/Retention Interventions

- US National Science Foundation (NSF) and others have spent (at least) tens of millions of dollars

- Nothing has had much of an effect, at least on recruitment

- The scientific approach suggests that we look for something that developmental psychology research can tell us about gender-related differences in college major/career choice

SMPY

- SMPY = Study of **M**athematically (and scientifically) **P**recocious **Y**outh (MPYs)
  - Begun, at John Hopkins, in 1971, by Julian Stanley, who started an early magnet HS for MPYs
  - Moved to Iowa State in 1986, under the direction of Camilla Benbow
  - Directed by Camilla Benbow and David Lubinski, at Iowa State, 1991-1998
  - Moved to Vanderbilt in 1998, still under the direction of Benbow and Lubinski

SMPY's Purpose

- SMPY's purpose was to identify, study, and improve the education of MPYs so that they would choose and succeed in STEM careers:
  - Magnet schools
  - Improved pedagogy
  - etc.

SMPY: Long Term Longitudinal

- SMPY has been going on for 35+ years

- Hundreds of MPYs have been involved

- MPYs entered SMPY in *middle school* (at age 12-13)

- MPYs have been followed into *middle age*

Incidental Findings of SMPY (Females): I

- Absent mitigating political/financial/social constraints, MPY females go into Science, Technology, Engineering, and Math (STEM) fields involving organic things, i.e., fields involving people, helping people, etc.:
  - Gender balance in biology and near gender balance in many of its variants
  - Gender balance in medicine, and in bioengineering
  - Considerably larger numbers of women than men in psychology, sociology, etc.

Incidental Findings of SMPY (Females): II

- Female MPYs are better at communication and other inter-personal skills than are young men, so they also go into non-STEM fields like law, advertising, etc.

Incidental Findings of SMPY (Males):

- Absent mitigating political/financial/social constraints, MPY males go into STEM fields involving inorganic things, i.e., fields involving machines, abstractions etc.:
  - Software development
  - Computer hardware
  - Various other branches of engineering
  - Physics
  - Chemistry, but women are getting close in biochemistry

Enlightened SD Educators' Feelings

- The early emphasis on programming turns off young women because:
  - Programming is geeky (the way young men become obsessed with it)
  - But young women are socially oriented
  - ***Many boys start programming in middle school or HS, and discovering this causes young women to lose their self efficacy. (Margolis & Fisher CMU study)***

Further Enlightenment

- SMPY explains why there were far more young women in SD-related majors, and far more female programmers until around 1980
- SMPY also explains why there's perfect gender balance in SD-related majors in countries like India

So…?

- If there's nothing organic about SD, then there's no point in trying to recruit many more young women
- Is there anything organic about SD

What Else is Software Development

- 20%-30% of SD involves programming
- The pre-programming phase consists of:
  - Requirements engineering – interpersonal interaction
    - Young women are far better at this than young men. (Among other things, they listen to what the client is saying s/he wants.)
  - GUI design: HCI-related
  - Construction of prototype users' manual – written communication
  - Database design
  - Teamwork
- …and members of which gender are more interested in and better at all the above?
- The rest of the SD life cycle requires many other organic skills at which women excel…and they make good programmers too!!!

Our Initiative: Real Projects for Real Clients Courses (RPRCCs) I

- A *real client* is a person (organization) who wants software to solve a problem or provide a service

- A *real project* is one in which a team of students develops such software, working as a team (problem-based learning, just like learning programming)

- An *RPRCC* is a course in which students work in teams on real projects for real clients

Our Initiative: Real Projects for Real Clients Courses (RPRCCs) II

- **HS recruitment**: pre-implementation RPRCCs with socially relevant agencies as clients, e.g., adoption agencies, child care agencies, poverty agencies, etc. Students, working in teams:
  - Interact with the client, and other critical stakeholders to determine requirements
  - Construct a prototype GUI embedded in a (prototype) users manual
  - Construct a RDB design
- **Pre-choice-of-major undergrad recruitment (in most US colleges/universities)**: pre-implementation RPRCCs with socially relevant agencies as clients

Our Initiative: Real Projects for Real Clients Courses (RPRCCs) III

- ***Retention***: RPRCCs throughout the curriculum, including a pre-programming RPRCC concurrent with CS1, with the following types of clients:
  - Socially relevant agencies
  - College/University faculty and staff
  - Industry and government

Interested in Participating?